

RESISTANCE OF SOME CRUCIFERS TO ALTERNARIA
BRASSICAE (Berk) Sacc.

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INTRODUCTION

Black spot due to Alternaria brassicae infection is frequent on oilseed rape, and under certain conditions can result in significant yield loss. Resistance of several crucifer to a french strain of A. brassicae is described and discussed in this paper. Tests involved study of infection of cotyledonary stages in controlled climatic conditions, and of infection of pods.

MATERIAL and METHODS

Infection under field conditions is variable and dependent on climate, in particular : high temperatures of the order of 22°C, and alternance of wet and dry periods favour proliferation of the parasite. The present study of source of, and variability in resistance to the parasite was therefore experimental.

1. TEST on COTYLEDONARY STAGES

The test was adapted from that describes for Phoma (WILLIAMS, 1985). Seeds were subjected to 48 hrs pregermination at 20°C on moistened filter paper. Ten seeds per genotype, were then planted, two per 8cm diameter pot, in a mixture of 1/3 fresh soil, 1/3 sand and 1/3 peat. Plants were grown and tested in a constant growing chamber at 18°C. A. brassicae spores taken from a sixteen day culture on V8 medium were suspended at $5 \cdot 10^7$ spores/ml and 10^8 spores/ml in sterile water. Two calibrated 10 μ l droplets were placed on each cotyledon eight days after establishment. Evaporation was prevented by holding plants for 17hrs in darkness in small covered plastic boxes. The droplets were then remove with filter paper, and box covers removed. Conditions in the room were then 18°C, 80% relative humidity, and 14hrs light. Plants were scored 48 and 96hrs later as follows.

0. No apparent infection.
1. 1 to 2 spots
2. 2 to 7 distinct spots.
3. 8 to 15 distinct spots.
4. Extended spotting, but whole surface of droplet location not completely covered.
5. Whole droplet location completely covered.

Only the highest score for each plant retained for analysis.

2. TEST on CUT MAINS

Mainstems from stage G4 plants (first ten pods showing rounding) were collected in the fields, five per genotype, and placed in jars with water. They were then sprayed with a 1.10^4 spore/ml suspension until stems dripped water. Mainstems were then kept in constant temperature at 20°C with relative humidity between 85% (day) and 100% (night). Samples were scored fifteen days later, for 30 randomly chosen pods per mainstems. Scoring was as follows:

0. No apparent infection
1. 1 to 3 visible spots.
3. 4 to 10 visible spots.
5. Up to 20 visible spots or no more than 1/4 pod affected.
7. High spot density on a single valve or no more than 1/2 pod affected.
9. High spot density on two valves or 1/2 pod affected.

RESULTS.

1. TEST at COTYLEDONARY STAGE.

Brassica campestris from various area all showed greater sensitivity than oilseed rape varieties, Bruto, and Jet Neuf, except for Arkus. However, some variability in resistance appeared between turnips (Table 1). All radish varieties (Raphanus sativus) tested were similar seed in sensitivity (Table 2). Brown mustard (Brassica juncea) was more sensitive (Table 2). Significantly higher levels of resistance were found for white mustard genotype (Sinapsis alba) as compared with oilseed (Table 3). Lesions were small, and limited in extent.

2. TESTS on MAINSTEMS PODS

Some variability in oilseed resistance was found (Table 4). Jet Neuf had best resistance to inoculation of pods. White mustards had lower attack levels compared to oilseed, for all genotype. Black mustards (Junius spp) had intermediate response, while radish was at least sensitive as oilseed.

Species	Genotype	Mean scores 1 to 5	Test for homo- geneity (1)
<i>Brassica napus</i>	BRUTOR	0.58	A
<i>B. napus</i>	JET NEUF	0.83	A B
<i>B. campestris</i>	ARKUS	1.08	A B
<i>B. c.</i>	CHICON	1.83	B C
<i>B. c.</i>	PREKO	1.94	B C
<i>B. c.</i>	DAISY	2.50	C D
<i>B. c.</i>	IARI	2.75	C D
<i>B. c.</i>	TORIA 6	2.83	C D
<i>B. c.</i>	ZW311	3.17	C D E
<i>B. c.</i>	APPIN	3.33	D E F
<i>B. c.</i>	TORIA 13	3.42	D E F
<i>B. c.</i>	DYS 1	3.58	D E F
<i>B. c.</i>	T25 YSP	3.58	D E F
<i>B. c.</i>	YSP	3.58	D E F
<i>B. c.</i>	D21	4.25	E F
<i>B. c.</i>	R5000	4.33	E F
<i>B. c.</i>	TEXI	4.58	E F
<i>B. c.</i>	T17	4.58	E F
<i>B. c.</i>	T7	4.58	E F
<i>B. c.</i>	T26	4.67	F

TABLE 1 : Mean infection scores for turnip genotype at cotyledonary stage.

Species	Genotype	Mean scores 1 to 9	Test for homo- geneity (1)
<i>Sinapis alba</i>	EMERGO	0.96	A
<i>Brassica napus</i>	JET NEUF	4.71	B
<i>B. n.</i>	BRUTOR	5.54	B C
<i>Raphanus stivus</i>	RESAL	5.61	B C
<i>R. s.</i>	PEGLETTA	5.68	B C
<i>R. s.</i>	NEMEX	5.75	B C
<i>R. s.</i>	REMUS	6.29	B C
<i>R. s.</i>	CLOVIS	6.35	B C
<i>R. s.</i>	SILETTINA	6.45	B C
<i>R. s.</i>	IRIS	6.54	B C
<i>R. s.</i>	SILETTA	6.75	B C
<i>Brassica juncea</i>	PICRA	8.78	C

TABLE 2 : Infection indices of radish tested at cotyledonary stage

(1) : Newman & Keuls

Species	Genotype	Mean scores 0 to 5	Test for homo- geneity (1)
<i>Sinapis alba</i>	3178	0.70	A.
S. a.	1676	0.83	A.
S. a.	977	0.93	A.
S. a.	1477	0.98	A B
S. a.	EMERGO	1.15	A B
S. a.	1375	1.20	A B
S. a.	CARLA	1.28	A B
S. a.	277	1.48	A B
S. a.	SIGNAL	1.55	A B
S. a.	CARINE	1.57	A B
S. a.	SERVA	1.75	A B C
S. a.	DIALBA	1.78	A B C
S. a.	6718	1.85	A B C
S. a.	PERRINE	2.41	B C D
S. a.	MAXI	2.90	C D E
<i>Brassica napus</i>	JET NEUF	3.10	D E
B. n.	BRUTOR	3.75	E F
<i>Brassica juncea</i>	PICRA	4.50	F

TABLE 3 : Mean infection scores for white mustard genotype at cotyledonary stage.

(1) : Newman & Keuls

Genotype Species	Attack index 0 to 9	Test for homogeneity (1)
JET NEUF	3.08	A
LEMKES	3.97	A B
BIENVENU	4.16	A B
MATADOR	4.76	A B
AZTEC	5.00	A B
VICTOR	5.31	A B C
RAPORA	5.48	A B C
DAMOR	5.65	A B C
JUPITER	6.22	B C
SYNRA	6.26	B C
BELINDA	6.71	B C
KORINA	7.84	C

TABLE 4 : Pod attack index (0-9) for alseed rape genotype.

Genotype Species	Attack index 0 to 9	Test for homogeneity (1)
2375 S.a.	0.12	A
6718 S.a.	0.18	A
MAXI S.a.	0.18	A
SERVAA S.a.	0.27	A
1676 S.a.	0.32	A B
CARINE S.a.	0.35	A B
3277 S.a.	0.37	A B
1477 S.a.	0.38	A B
3178 S.a.	0.40	A B
1375 S.a.	0.43	A B
SIGNAL S.a.	0.72	A B
277 S.a.	0.73	A B
977 S.a.	0.88	A B
CARLA S.a.	0.93	A B
EMERGO S.a.	1.17	A B
DIALBA S.a.	1.17	A B
475 S.a.	1.23	A B
PERRINE S.a.	1.49	A B
JUNIUS B.ni	2.67	B
CRESOR 1 B.n.	4.90	C
CRESOR 2 B.n.	5.37	C
BRUTOR 1 B.n.	5.47	C
BRUTOR 2 B.n.	5.50	C D
REMUS R.s	5.67	C D
PEGLETTA R.s	5.80	C D
IRIS R.s	6.70	C D
RESAL R.s	6.73	D
CLOVIS R.s	7.53	D

TABLE 5 : Pod attack indice for crucifer species after artificial inoculation of mainstem.

(1) : Newman & Keuls

DISCUSSION

Test result reveal a source of resistance in white mustard and high sensitivity in turnip rape which confirms results obtained by HUSAIN and THAKUR, 1963. Result of tests at cotyledonary stage correlate with those for pod tests, and demonstrate the interest of early testing. Transfer of white mustard resistance to oilseed rape is currently being attempted, using protoplasmic fusion hybrids (PRIMARD and al., 1987).

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